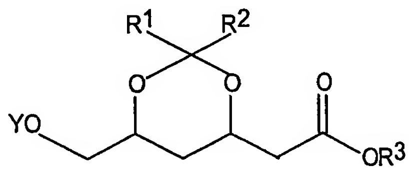
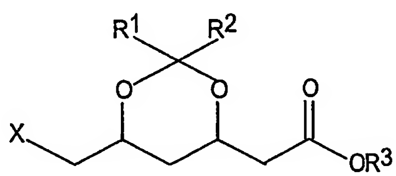
PROCESS FOR PREPARATION OF 2- (6-SUBSTITUTED -1, 3-DIOXANE-4-YL) ACETIC ACID DERIVATES

The invention relates to a process for the preparation of a 2-(6-substituted)-1,3-dioxane-4-yl) acetic acid derivative according to formula 1,



(1)

wherein R^1, R^2 and R^3 are each independently a C1-4 alkylgroup or wherein R^1 and R^2 together with the C-atom to which they are bound form a 5- or 6-membered cycloalkyl and wherein Y stands for R^A-CO- or for R^B-SO_2- with R^A, R^B are chosen from the group of alkyl or aryl with 1-12 C-atoms, from its corresponding 2-(6-substituted)-1,3-dioxane-4-yl) acetic acid derivative according to formula 2,



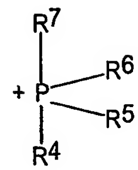
(2)

wherein R^1, R^2 and R^3 are as defined above and wherein X stands for a halogen, in the presence of a phase transfer catalyst and an oxylating agent.

Such a process is known from EP 1 024 139, wherein the preparation of a compound according to formula 1 from a compound according to formula 2 is achieved in the presence of a quaternary ammonium salt (phase transfer catalyst) and a carboxylic acid salt (acyloxylating agent).

It is the object of the invention to provide an alternative process for the preparation of a 2-(6-substituted)-1,3-dioxane-4-yl) acetic acid derivative according to formula 1 from its corresponding 2-(6-substituted)-1,3-dioxane-4-yl) acetic acid derivative according to formula 2.

This is achieved according to the invention by using a quarternary phosphonium ion according to formula 3 as a phase transfer catalyst,



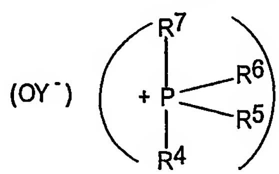
(3)

wherein R^4, R^5, R^6, R^7 each independently stand for an alkyl, cycloalkyl, aralkyl or aryl with 1 to 12 C-atoms, and an ion according to formula 4,

$$OY^- \qquad (4)$$

wherein Y is as defined above, as an oxylating agent. The reaction has a high yield.

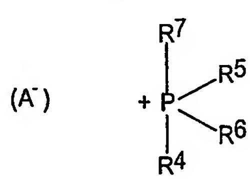
The quarternary phosphonium ion according to formula 3 used as a phase transfer catalyst and the ion according to formula 4 used as an oxylating agent may be present in a quarternary phosphonium salt according to formula 5,



(5)

wherein Y, R^4, R^5, R^6 and R^7 are as defined above. The phosphonium salt according to formula 5 can be used as both a phase transfer catalyst and as an oxylating agent. The quarternary phosphonium salt according to formula 5 can be prepared according to methods known to the person skilled in the art (e.g. analogous to the preparation of tetra-n-butylammoniumacetate as described in US 5 278 313).

In a preferred embodiment of the invention, the phase transfer catalyst and the oxylating agent are not present in the same molecule. In this embodiment, a quarternary phosphonium salt according to formula 3a,



(3a)

wherein R^4, R^5, R^6 and R^7 are as defined above and wherein A stands for the anion of the quarternary phopshoniumsalt and is selected from the group of halogens, for example Cl, Br, I is used as a phase transfer catalyst and the acid salt according to formula 4a,

$$(OY^-)_n \; M^{n+} \qquad (4a)$$

wherein Y is as defined above, wherein M stands for alkali metal or an alkaline metal,

for example Li, K, Na, Mg, Ca, Ba and wherein n represents an integer of 1 or 2, depending on the valence of M is used as an oxylating agent. Preferred is M is K or Na.

In the process according to the invention, halogens X are preferably Cl, Br or I, more preferably Cl.

In the process according to the invention, R^1, R^2 and R^3 are preferably a C1-4 alkyl group, more preferably R^1 and R^2 are a methyl or an ethyl group, more preferably a methyl group. R^3 is preferably a methyl or a butyl, most preferably a t-butyl.

In the process according to the invention Y groups are preferably represented by R^A-CO- or R^B-SO_2-, wherein R^A, R^B are chosen from the group of C_1-C_4 alkyl or aryl with 6-10 C-atoms. In a preferred embodiment, Y is chosen from the group of acyl, more preferably acetyl (with R^A is CH_3), benzenesulphonyl (with R^B is benzene), more preferably nitro substituted benzenesulphonyl (with R^B is p-nitro-benzene), tosyl (with R^B is p-methyl-benzene) or mesyl (with R^B is methyl).

In the process according to the invention, preferably a phosphonium salt according to formula 3a or according to formula 5, with at least three out of four R groups are the same (e.g. R^4, R^5, R^6 are butyl and R^7 is methyl or R^4, R^5, R^6 are phenyl and R^7 is butyl), more preferably a phosphonium salt with all four R groups are the same, is used.

R^A and R^B and R^4, R^5, R^6, R^7, -in case R^4, R^5, R^6, R^7 are aryl or aralkyl-, may be substituted for example with substituents chosen from the group of halogens, alkoxy (e.g. methoxy or ethoxy) with 1-6 C-atoms, alkyl with 1-6 C atoms, (e.g. methyl if R^B is toluene) or nitro, preferably only R^A or R^B are substituted.

The quarternary phosphonium salt according to formula 3a is preferably used in a molar equivalent amount of 0.01 to 1.0, more preferably 0.05 to 0.7, most preferably 0.1 to 0.5 relative to the amount of compound according to formula 2.

The quarternary phosphonium salt according to formula 5 is preferably used in a molar equivalent amount of 0.8 to 5, preferably 1 to 3, most preferably 1 to 1.5.

The acid salt according to formula 4a is preferably used in a molar equivalent amount of 1 to 5 relative to the amount of compound according to formula 2 present. More preferably, a molar equivalent amount of acid salt according to formula 4a of 1 to 4, most preferably 2 to 3, is used.

The solvents suitable for use in the present invention are a various

number of organic solvents, which are known to the person skilled in the art. Organic solvents, which may be used are hydrocarbon series solvents, for example benzene, toluene, cyclohexane, etc.; ether series solvents, for example diethyl ether tetrahydrofuran, 1,4-dioxane, methyl-t-butyl ether, dimethoxyethane, etc.; ester series solvents, for example ethyl acetate, butyl acetate, etc.; halogen containing solvents, for example methylene chloride, chloroform, 1,1,1-trichloroethane, etc.; nitrogen-containing solvents, for example acetamide, formamide, acetonitrile etc.; and aprotic polar solvents, for example dimethyl sulfoxide, N,N-dimethylformamide, N-methylpyrrolidone, hexamethylphosphoric triamide etc. Preferably, the solvent used is an aprotic polar solvent, more preferably the solvent used is N-methylpyrrolidone or N.N-dimethylformamide. The solvent can be used alone or in combination with one or more other solvent species, for example N-methylpyrrolidone in combination with toluene.

The temperature, by which the process of the invention is preferably carried out, is between 80 and 200°C, more preferably between 100 and 160°C, most preferably between 110 and 150°C.

The reaction product can be isolated from the reaction medium, if desired, according to methods known to the person skilled in the art (e.g. the method as described in US 5 278 313).

The invention will be illustrated by way of the following examples. However, these examples are not meant to restrict the invention.

<u>Examples</u>

<u>Example 1</u>

0.5 molar equivalents tetrabutylphosphoniumbromide (TBPB) and 2.5 molar equivalents potassiumacetate were added to a solution of I (tert-butyl 2-[(4R,6S)-6-(chloromethyl)-2,2-dimethyl-1,3-dioxan-4-yl]acetate in the solvent N-methylpyrrolidone (1g/3ml) at 100°C. The conversion of I in the presence of TBPB was 87.6% after 20 hours reaction time, the conversion of I into II (tert-butyl 2-{(4R,6S)-2,2-dimethyl-6-[(methyl-carbonyloxy)methyl]-1,3-dioxan-4-yl} acetate) thereof being 90.3%.

<u>Example 2</u>

Example I was repeated whereby the reaction temperature for the conversion of I into II was kept at 115°C. The conversion of I in the presence of TBPB was 95.1% after 3 hours reaction time, the conversion of I into II thereof being 91%.

Example 3

0.1 molar equivalents tetraphenylphosphoniumbromide (TTB) and 2.5 molar equivalents potassiumacetate were added to a solution of I (tert-butyl 2-[(4R,6S)-6-(chloromethyl)-2,2-dimethyl-1,3-dioxan-4-yl]acetate in the solvent N-methylpyrrolidone (1g/3ml) at 140°C. After 20 hours, the conversion of I was 97%, the conversion of I into II thereof being 77.2%.